

DISPLAY ARRANGEMENTBACKGROUND OF THE INVENTION

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## Field of the Invention

The present invention relates to a display arrangement for holding a liquid crystal display (LCD) in a communication terminal that minimize the impact of external forces applied on the display arrangement.

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## Description of Prior Art

Display holder arrangements are widely known in different electronic equipment. The display arrangement in electronic equipment aims to firstly hold the display for it to perform its purpose, but also secondly protect the display from the impact from any external forces applied on the electronic equipment. The second purpose of protecting the display is of particular importance for portable devices that easily can be dropped and that are handled less carefully.

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Communication terminals, like mobile phones, have the disadvantage that they can not be rigid enough to easily resist external forces, as they would be too clumsy for the normal user. Only specially designed craftsman phones, like Nokia 6250<sup>TM</sup>, have this very rigid design. In other phones or electronic equipment are the display arrangement designed to prevent impact on the displays by a flexible or adjustable mounting. More precisely were the earlier implementations of display arrangements in communication terminals constructed so that the LCD module was supported by the sidewalls or placed towards the sidewalls, and held in its position by the surrounding mechanics, that were applied directly on the LCD module. This caused a lot of problems with cracking displays after the communication terminal accidentally had been dropped.

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An example of earlier solutions has been described in the prior art document GB 2190529 A. In document of GB 2190529 A is described a liquid crystal display

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(LCD) mounted on a printed circuit board. The LCD is mounted behind an opening the edges of which serve as a bezel for the LCD. A resilient gasket extends the around the periphery of the LCD and is sandwiched between the LCD and the bezel to prevent movement of the LCD relative to the housing. Another examples  
5 of display arrangement are EP 0939 532 A2, EP 0709714 B1 and FR 2674295 A1, that all describes solution where the display has been rigidly positioned in a housing and where the display not is provided with provisions for flexibility.

The claimed invention aims to provide an improved display arrangement that  
10 solves the above-mentioned problems.

#### SUMMARY OF THE INVENTION

It is an object of the present invention is to provide a display arrangement that is flexible and where a liquid crystal display (LCD) module can resist externally applied forces on the display arrangement.  
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According to a first preferred embodiment of the claimed invention this objective is obtained by a display arrangement that has a gap between the LCD module and the surrounding mechanics and where flexible material is used to retain the relative position of the LCD module to the surrounding mechanics.  
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Another object of the invention is to a method for arranging a LCD in relation to a housing to enable a flexible display that adjusts to externally applied forces on a display arrangement and thereby minimize the risk cracking of the LCD.

25 According to an preferred embodiment of the claimed invention this objective is obtained by a method for establishing a flexible display arrangement, where a liquid crystal display (LCD) is attached to a housing by provisions of an adhesive member along the periphery of the bottom surface of the LCD, having a cavity between the side walls of the housing and the side periphery of the LCD, and  
30 further applying an elastic member between the top surface of the LCD and the housing.

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Yet another object of the invention is to provide a method for mounting a display module in a display arrangement to provide that the LCD retains a relative position to the rest of the display arrangement.

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According to the preferred embodiment of the claimed invention this objective is obtained by a method for arranging a LCD in relation to a housing in an electronic equipment comprising the steps of applying an adhesive member along the periphery of the bottom surface of the LCD and attaching the LCD to a first housing part, mounting a second housing part including a elastic member on the first member, as to enabling the elastic member to establishing a pressure on the LCD, and retaining a relative position between the LCD and the housing parts.

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#### BRIEF DESCRIPTION OF THE DRAWING

The invention will be explained more fully below, by way of example, in connection with preferred embodiments and with reference to the drawing, in which:

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Figure 1 show in two different perspective views a known embodiment of a communication terminal.

Figure 2 schematically shows the essential parts of a telephone for communication with a cellular network.

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Figure 3 shows a display arrangement and the topside of a liquid crystal display module in the display arrangement.

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Figure 4 shows a cross section of the display arrangement according to the invention.

Figures 5 shows a part of a detailed cross section of the display arrangement according to the invention.

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## DETAILED DESCRIPTION OF THE INVENTION

According to a first aspect the display arrangement according to the invention will be described with reference to a hand portable phone, preferably a cellular/mobile phone. An embodiment of this phone is shown in figure 1, where a cellular/mobile phone 1 is shown in perspective. As will be seen, the phone is provided with a front cover 2 having a window frame 3 encircling the protection window of the display assembly 3. The cellular/mobile phone comprises a user interface having an on/off button 4, a speaker 5 (only openings are shown), a keypad 7, a battery 14, a display/LCD 3 and a microphone 6 (only openings are shown).

The keypad 7 has a first group of keys 8 as alphanumeric keys, by means of which the user can enter a telephone number, write a text message (SMS), write a name (associated with the phone number), etc. Each of the twelve alphanumeric keys 8 is provided with a figure "0-9" or a sign "#" or "\*", respectively. In alpha mode each key is associated with a number of letters and special signs used in the text editing.

The keypad 7 additionally comprises two menu selections or soft-keys 9, two call handling keys 12, and a navigation-key 10. The function of the soft-key depends on the state of the phone and the navigation in the menu by using a navigation-key. The present function of the menu selection keys 9 is shown in separate fields in the display 3 just above the keys 9. The two call handling keys 12 are used for establishing a call or a conference call, terminating a call or rejecting an incoming call. This key layout is characteristic of e.g. the Nokia 6210™ phone.

The navigation-key 10 is an up/down key and is placed centrally on the front surface of the phone between the display 3 and the group of alphanumeric keys 8. Hereby the user will be able to control this key with his thumb. This is the best site to place an input key requiring precise motor movements. Many experienced phone users are used to one-hand handling. They place the phone in the hand between the fingertips and the palm of the hand. Hereby the thumb is free for inputting information.

Figure 2 schematically shows the most important parts of a preferred embodiment of the phone/terminal, said parts being essential to the understanding of the invention. The microphone 6 records the user's speech, and the analogue signals formed thereby are A/D converted in an A/D converter (not shown) before the speech is encoded in an audio part 20. The encoded speech signal is transferred to a processor 18 (physical layer processor), which e.g. supports GSM terminal software. The processor 18 also forms the interface to the peripheral terminals of the apparatus, including RAM and ROM memories 17a and 17b, a SIM card 16, the display 3 and the keypad 7 (from figure 1) as well as data, power supply, etc. The processor 18 controls the communication with the network via the transmitter/receiver circuit 19 and an antenna 21. The audio part 20 speech-decodes the signal, which is transferred from the processor 18 to the speaker 5 via a D/A converter (not shown).

The processor 18 is connected via a bus 24 to a RAM memory 17a and a Flash ROM memory 17b, a SIM card 16, the display 3 and the keypad 7 (as well as data, power supply, etc.). Furthermore a phonebook 23 is connected to the processor 18 via the bus 24. The phonebook 23 may be stored on the SIM card 16, and/or in the Flash ROM memory 17a.

Figure 3 schematically show a display arrangement according to a first embodiment of the claimed invention. A display module 30 includes a liquid crystal display (LCD) 31 having a frame 32, connector pads 33 and lines (not shown) connecting the LCD 31 to the connector pads 33. The connection between the connector pads 33 and the printed circuit board has been left out from figure 3 to simplify it. All the way around the LCD module 30 is an air gap or cavity 34, and outside the gap or cavity is located a light guide 35, wherein the LCD module has been disposed.

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The exact design of the rest of the lightguide is not a part of the invention, but is substantially similar to lightguides used in e.g. Nokia 6210<sup>TM</sup>, 3310<sup>TM</sup>, 3330<sup>TM</sup> or

6510<sup>TM</sup>. The hatched section 36 around the inner periphery 37 of the lightguide 35 symbolize the rest of the lightguide 35. The reference A-A in figure 3 is shown as a cross section in figure 4. The cross section of the lightguide 35 is more clear as well as the of the LCD module 30. The air gap or cavity 34 around the LCD module 30 is also shown together with an air gap or cavity 38 between the bottom surface of the LCD module 30 and the lightguide 35. Further is included a metal frame 39 that has been placed on top of the lightguide 35 to hold the LCD module 30 in position. The metal frame has been provided with an elastic gasket 40 along the inner periphery of the metal frame 39 to establish a flexible pressure on the topside of the LCD module 30. The flexible pressure enables the LCD module 30 to adjust to externally applied forces on the display arrangement that otherwise would risk to crack under the externally applied forces.

The metal frame 39 can be hold in its position by clips (not shown), snapping provisions or be provided with cut outs wherein welded plastic from the lightguide can project and thereby holding the metal frame in position. The metal frame 39 can cover over parts than the display arrangement that surrounds the display arrangement.

In figure 5 is shown an enlarged part of the display arrangement including the lightguide 35, the LCD module 30, the metal frame 39 and the elastic gasket 40. It also shows an adhesive member 42 that has been applied along the periphery of the bottom surface of the LCD module 30. Outside and inside the adhesive 42 is an air gap 34 respectively 38 between the LCD module 30 and the lightguide 35. The adhesive 42 has elastic properties to enables absorption on externally applied forces, similar properties to those of the elastic gasket 40. The absorption of externally applied forces minimizes the impact on the LCD module 30, and the risk that the LCD 31 cracks.

The end 43 of the elastic gasket 40 appears to enter into the LCD module 30, but this is made only to show that the elastic gasket end 43 comprises to some degree in order to apply a holding pressure on the LCD module 30.

The elastic gasket 40 is further provided with a flange 41 that serves as dust protection for the LCD module 30 and a protection window (not shown) on a front cover 2. It does not need to be a lightguide that surrounds the LCD module, but

5 can be any kind of surrounding mechanics or fixture, as long as there is an air gap or cavity around the LCD module. The lightguide can be replaced by an illuminating foil or other provisions that can supply the LCD module with light for illumination.

- 10 The invention is not limited to the above-described examples or to the drawings showing examples of an embodiment, but can be varied within the scope of the appended claims.

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**ABSTRACT****DISPLAY ARRANGEMENT**

- 5 The invention relates to a display arrangement for establishing a flexible mounting of a liquid crystal display (LCD) module in an electronic equipment for minimize the impact on the LCD module of externally applied forces on the electronic equipment, e.g. dropping the electronic equipment. This is managed by having a gap between the LCD and the surrounding mechanics in the electronic equipment.
- 10 The LCD module is positioned in relation to the surrounding mechanics by provisions of elastic and adhesive members between the LCD module and the surrounding mechanics in the electronic equipment.

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